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REPORTS

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No. 3,4163-32

Engelmann Spruce Bark Beetle Control Project Colorado 1951

U S Department of Agriculture
Forest Service
and
Bureau of Entomology and Plant Quarantine

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Fort Collins, Colorado
March 12, 1952

To: J. A. Beal, In Charge, Forest Insect Investigations

From: Noel D. Wygant, Entomologist in Charge, By: B. H. Wilford
Entomologist

Subject: Report "Engelmann Spruce Bark Beetle Control Project, Colorado, 1951"

Enclosed are 5 copies of the report "Engelmann Spruce Bark Beetle Control Project, Colorado, 1951" prepared and mimeographed by the U. S. Forest Service. We have additional copies for distribution. Should you wish more than these 5 copies please let us know.

As stated in its introduction the report is "a follow-up of the 1950 report" and "outlines the control work . . . . . from the close of the 1950 job through the 1951 operating season."

cc Brown
Baton
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Furniss
Keen
Kowal
Orr
Speers
Whitten
Yuill

B. H. Wygant

Clbe n 3-17
Johnson 3/17
Terrell 3/17
Trostle 3-27
Denton 3/25
Evenden

FOREWORD

The 1951 control program against the Colorado Engelmann spruce beetle infestation marked the second year in which active control measures were undertaken against this epidemic. Two agencies of the United States Department of Agriculture participated in this program: the Bureau of Entomology and Plant Quarantine and the Forest Service. Both agencies detailed men from various parts of the United States to help out on this project.

The entomologists conducted a survey of 1951 attacks for use in planning the 1952 control program and served as technical assistants in each of the control camps. Foresters carried out the control program with detailers serving as members of spotting crews and in supervisory and facilitating positions in the camps, areas, and director's offices.

In Region 2 of the Forest Service it became necessary for all of the forests and most of the divisions in the regional office to detail personnel to the project because of its urgency and importance, and the short time limitations for accomplishment of the job. This, in turn, meant some sacrifice in regular work accomplishment. It placed heavier burdens on remaining personnel and required of them a high degree of efficient operation to carry on in meeting the regular public service needs.

The personnel of the Region deserve a maximum of credit for the successful operation of this important project, and, at the same time, carrying on their regular work without a sharp lowering of standards in performance of their over-all job in national forest administration.

Donald E. Clark

DONALD E. CLARK
Regional Forester

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INTRODUCTION

This will be a follow-up of the 1950 report of the Colorado Insect Control Project which contained an abstract of events leading up to 1950, the history of the outbreak, and the values at stake.

This report outlines the control work undertaken in 1951 and will be confined to the operational and planning phases of the project from the close of the 1950 job through the 1951 operating season. It does not include the material mentioned above.

THE 1951 CONTROL PROJECT

Planning the 1951 Project

In the fall of 1950 the Bureau of Entomology and Plant Quarantine completed its survey of 2,800,000 acres of spruce timber situated on the western slope of Colorado. This survey formed the basis of the initial planning work for the 1951 project. It indicated a need for treating 1,643,000 trees on 51 separate units. This survey confirmed earlier indications of the extent and intensity of the Engelmann spruce beetle infestation across the White River Flattops to newly infested areas.

Based on the survey data a request was made for $3,895,000 to finance the 1951 control program. This was based on a cost of $2.37 per tree, which was the unit cost of the 1950 control program. Of the total amount requested $150,000 was estimated to be available from 1951 fiscal year funds appropriated for the 1950 project. The balance was requested from Congress.

This program envisioned the manning of 15 100-man camps, 3 60-man, and 6 20-man camps. It was planned to start treating by the middle of June and carry through until the last of September.

The Winter Freeze of 1951

On February 1, 1951, temperatures reached a record low at Eagle, Colorado, with a reading of minus 56 degrees and at Kremmling minus 49 degrees. Immediately afterwards, entomologists requested information from Forest Service field stations for temperature readings at all available stations within the infested areas. It appeared that the first real break in the form of control by natural factors had arrived. Earlier work by entomologists had determined that the sustained temperature of minus 30 degree beneath the bark would be lethal to the bark beetle. Temperature readings indicated that some mortality could be expected.

The entomologists immediately made a winter survey, contracting for the rental of "sno-cats" to gain access to all areas treated last year. Sections of infested trees were taken to the insect laboratory to be studied during the next few weeks when normal emergence of beetles in room temperatures would occur. These studies indicated that a high mortality of insect population had taken place.

During the latter part of June, 1951, and early July entomologists carried on further surveys to determine the extent of the winter kill. A more systematic sampling of individual units was planned and sections of infested trees were taken from widely scattered locations in each treating unit. This work confirmed the survey made during the winter in those areas examined during the latter survey. It was necessary to stop this work in mid-July before the work was completed because of the lack of funds for this project.

The following table shows the trend of the mortality in different areas:

Kremmling Area		Eagle Area	
Work Units	% Mortality	Work Units	% Mortality
Chimney Rock	98.67	Redtable Mtn.	81.87
Williams Ridge	98.18	Piney No. 1	73.94
Elliott Creek	92.68	Piney No. 2	81.18
Elk Mountain (3 areas)	97.88-92.09	East Brush	98.14
Cottonwood-Sheephorn		Hardscrabble Mtn.	97.71-76.45
N. W. Section	87.06	Basalt Mountain	99.94
Cottonwood Peak	95.11	Castle Peak	98.17
Piney Peak	81.32		
Slate Creek	81.13		

Camps

Early plans called for the establishment of camps in all major units of infestation. After the results of the winter mortality survey became known, it was apparent that a smaller program would be entomologically sound. When August 1 arrived and still no funds were available, new plans were made for a reduced program. By that time the entomologists were ready to recommend no treating whatsoever in the following units where winter mortality was high: Basalt Mountain, Castle Peak, and East Brush Creek, all on the Eagle Area; Elliott Creek, Williams Ridge, Beaver Creek, Elk Mountain, Gilsonite, and the Chimney Rock units, all on the Kremmling Area. The following units were recommended for treatment in 1951:

Kremmling Area

Cottonwood-Sheephorn (3 camps) and Rabbit Ears

Eagle Area

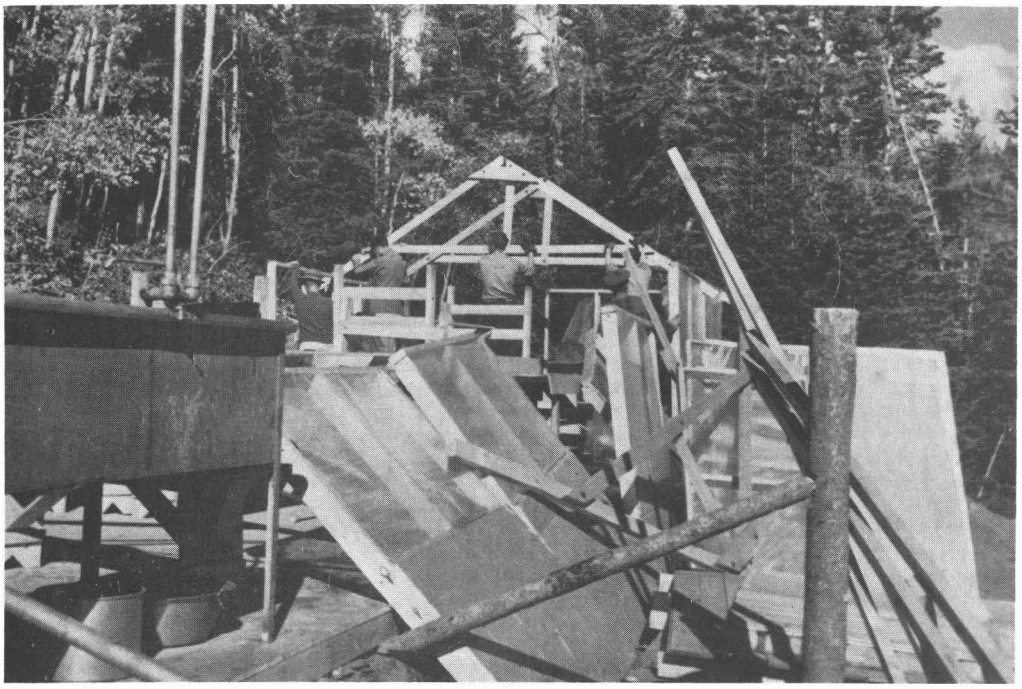
Hardscrabble Mountain, Piney, and Redtable Mountain

PLATE I

Beetle killed Engelmann spruce, adjacent to Trappers Lake Camp Ground, White River National Forest

Scene along headwater of White River National Forest, within Trappers Lake Camp Ground

PLATE II



The mess hall under construction at typical 100 man camp

A typical camp scene looking across superintendent's tent in foreground to mess hall and crew tents.

When the appropriation was made available on August 20 in the amount of $1,000,000 the area supervisors and the entomologists were called to Denver for an organizational meeting. Plans were made that day for the establishment of 100-man camps as follows: Kremmling Area; Cottonwood, East Sheephorn, Sheephorn, and possibly Rabbit Ears if it is later found desirable to treat the Rabbit Ears unit: Eagle Area; Hardscrabble, Piney, Gypsum Creek, and later Redtable Mountain, if possible.

Area Supervisor Leighou had already instructed crews to start the Hardscrabble unit camp before he came to Denver. This camp was started August 21 and treating got under way from this camp the following Monday, August 27. Camp construction started on the Kremmling Area on August 23 at the Sheephorn east camp and treating work started on August 29.

Labor Situation

During the first half of the calendar year assurance was received from the Bureau of Indian Affairs' Placement Officer that Indian labor could be supplied to fill the entire needs of the control program. After July 1 when the appropriation bill had not been passed and no commitments could be made for a possible starting date, part of this labor supply was lost to other employing industries. The agency was certain that there were still a good number of Indians on the reservation who would be willing to work in our control camps.

As a result of the publicity regarding the availability of funds for the project, a deluge of laborers from Denver and vicinity made themselves available as soon as the funds were appropriated. It was possible to completely man the first two camps with white labor from Denver, Kremmling, Eagle, and other Western Slope towns. Plans were made to use Indian labor in the remaining camps, three at each area, with future whites to be used for a possible turnover of help in these first two camps.

Immediately upon the start of the project, Forest Service regions were advised of those people who were desired for the project. By the time the project ended 51 people from other regions and stations were detailed to the project and 90 were called from Region 2.

The number of detailers from other regions and stations is as follows:

Region 1	15
Region 3	2
Region 4	8
Region 5	4
Region 6	6
Region 7	2
Region 8	7
Region 9	5
Central States Station	1
Northeast Station	1

The recruitment of labor for the project was most difficult because of the late start. In contrast to excellent weather in 1950, high mountain storms prevailed from the time the project started until it closed. This caused a constant turn-over of help in all the camps. By the time the project ended, 528 whites, 526 Navajos, 99 Zunis, 7 Utes, and 6 Cheyennes had been recruited, making a total of 1166 men.

The peak strength at the various camps was as follows:

Camp	Date Treating Started	Peak Size		Date Evacuated
		Date	Size	
Kremmling Area				
East Sheephorn	8-29	8-30	97	10-17
Cottonwood	8-29	9-5	100	10-25
Sheephorn	9-5	9-15	90	10-23
Buffalo Pass	9-13	9-22	73	10-12
Eagle Area				
Hardscrabble	8-27	8-28	97	10-12
Piney	8-30	9-1	100	10-16
Gypsum Creek	8-29	9-8	100	10-16
Red Creek	9-1	9-21	33	10-6

The Indians proved to be the best laborers for this type of work, with the Zunis excelling the work of the Navajos. The Zuni, an English-speaking Indian, was easier to work with and understood readily what was expected of him, whereas the Navajo had to be instructed through an interpreter.

Many of the Indians coming to the project from Arizona and New Mexico did not anticipate the cold climate that prevails in the high Rockies. It was therefore necessary to purchase additional clothing for them on a commissary basis, such as shoes, overshoes, caps, gloves, underwear, shirts, and trousers. These purchases enabled the Kremmling Area to retain their Indian help much longer than those who were employed on the Eagle Area where no commissary supplies were furnished.

Control Methods and Crew Organization

Treating of infested trees was carried on using equipment similar to that used on the 1950 project. Treating was by hand pump and the insecticide was 1 part of orthodichlorobenzene mixed with 6 parts of No. 1 burner fuel oil. This mixture was called "goop" or "ortho."

The ortho was hauled to control dumps adjacent to the treating area in 5-gallon cans and was redistributed along the jeep road nearest to the treating area. From here the cans of ortho, which weighed 50 pounds each, were transported by pack horse, 4 cans at a time, or carried by the "goop" carrier to the 2-man treating crew. This crew consisted of a nozzleman and pumpman and it was their job to properly apply the ortho to the standing trees.

The treating of trees involved spotting or locating of trees infested with beetles. Identifying trees requiring treatment was more difficult in 1951 than in 1950. This was due to winter mortality, the effect of the 1950 control program which reduced the insect population, and the concentration of woodpecker work which now had fewer trees on which to search for live beetles and larvae. The spotter proved to be the most important member of the treating crew, since it was necessary for him to blaze the trees requiring treatment, and to supervise the work of two control crews.

Trees were labeled by the spotter as follows:

3	=	3-foot treatment which was placed on trees heavily woodpeckered, usually 1950 attacks.
6	=	6-foot treatment, usually on 1950 attacked trees.
T	=	Full treatment, up to 30 feet in height, usually on 1951 attacks and on 1950 attacks not worked on by woodpeckers.

The control crew obliterated the above markings after treating was completed. String lines were laid out in advance of spotting, and served to hold control crews and spotters in the proper area. Because of the good judgment needed in determining proper selection and labelling of trees for treatment, the short term of the project, and the rapid turn-over of labor, it was fortunate that high caliber men, detailed from Region 2 and other regions, were available for the spotting jobs. They could be held for as long a period as needed and were able to give training to control crews and to additional spotters.

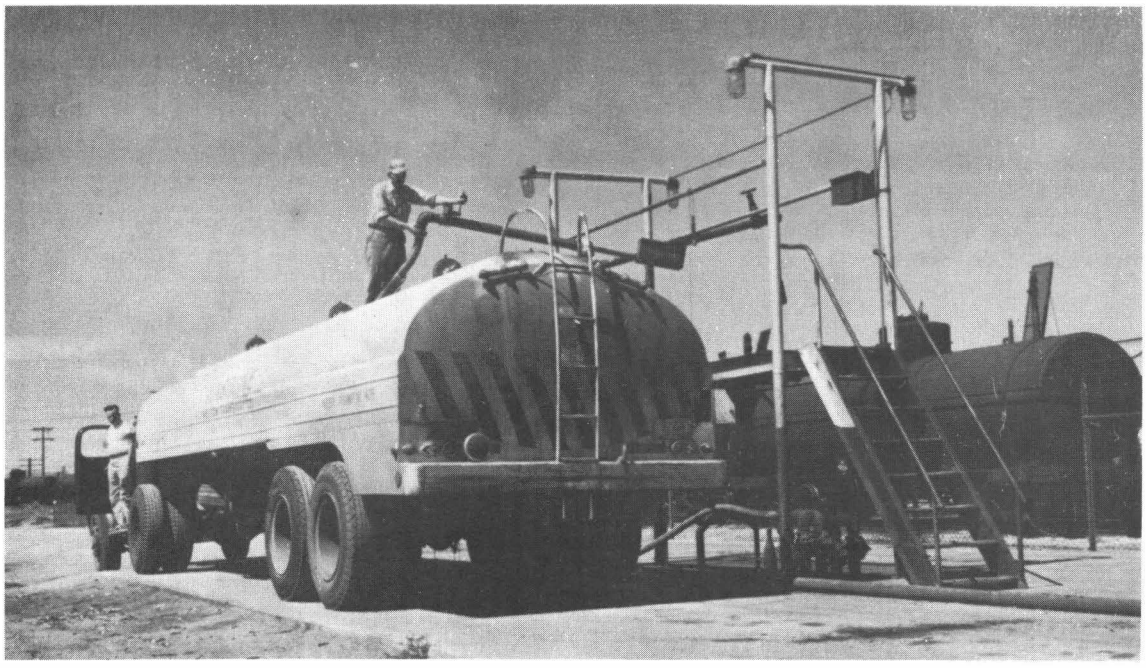
Training

A two day training program for spotters, foremen, camp superintendents, and area training officers was held on August 24 and 25 at the East Sheephorn camp work area. The entomologists took charge at the meeting and informed the trainees of the proper methods of spotting and treating. At this session the history of the insect epidemic, value of the control program, and expected accomplishments were emphasized. Improved techniques, developed on the 1950 project, were outlined at this session as well as proper safety measures.

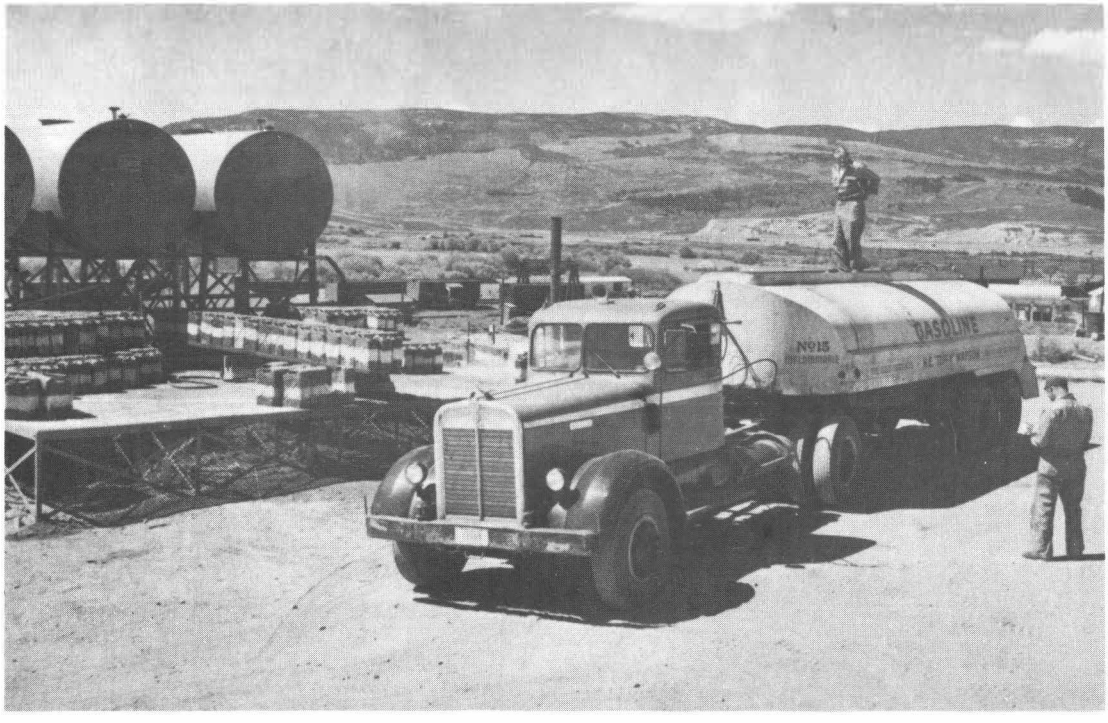
Because of the two year life cycle of the Engelmann spruce beetle, the short duration of this year's project, and the constant turnover of laborers, it was necessary to emphasize training throughout all the program. The nature of the 1951 infestation, coupled with winter kill and woodpecker work, complicated the spotting work. It was soon apparent that highly skilled spotters, such as junior foresters and assistant rangers, would be needed. After exhausting the supply in Region 2, a request was made to the Chief for 30 additional assistant ranger type men from other regions. These detailers proved invaluable for the work assigned to them.

It was soon apparent that a liaison man, working between the Bureau of Entomology survey crews and the Forest Service control crews, was needed on both areas. This man served as a field scout to determine just where control work would be undertaken in the individual treating units. He worked with the entomologists and, in some cases, did scouting work by himself. In this way the area supervisors knew just where control work was needed.

A training and safety officer was assigned to each area for training and safety work.



Filling commercial tank truck with insecticide mix at Denver refinery plant.



Unloading insectidide from commercial tank truck at Kremmling ortho depot.

Safety

Safety was constantly stressed in all phases of the work on both areas. Safety committees were organized in each camp and at both ortho depots. These committees consisted of key individuals in camps and a member of each seven man treating crew. The committees met weekly, made inspections of safety hazards, watched for the compliance of safety requirements, and made reports of their recommendations and findings at weekly safety meetings. The committees constantly pointed out hazards commonly overlooked and enabled everyone to become safety conscious. Proof that this method was successful can be gained by comparing the accident frequency rate of the 1950 project (36.56) with this year's record (15.86). The Kremmling area came through the season without any lost time accidents.

Motor Equipment

In the fall of 1950 surplus motor equipment from the United States Department of Agriculture Aftosa project in Mexico was obtained for the 1951 project. This equipment consisted mostly of $\frac{1}{4}$-ton jeep pickups and 1-ton power wagons. Sufficient equipment of this type was obtained to equip the full program as originally planned for this year. The reduced program that resulted in the lower appropriation and the late start used only part of the equipment on hand.

It was soon apparent after the program started that there was a shortage of heavier hauling equipment, such as $2\frac{1}{2}$-ton cargo trucks. The Chief's office located 15 surplus cargo hauling trucks from the Atomic Energy Commission at Hanford, Washington. These were purchased from the AEC and Region 6 of the Forest Service reconditioned them. Before they were available hauling was completed with stake trucks, power wagons, and a few cargo trucks loaned by the U. S. Air Force at Lowry Field, Denver. The $2\frac{1}{2}$-ton cargo trucks proved to be a life saver in providing transportation of ortho from the ortho depots to the work areas. A total of 274 motor vehicles were used this year; 31 cargo and stake trucks, 111 power wagons and weapon carriers, and 132 jeeps and jeep pickups.

Heavy maintenance and repair of all motor equipment was handled at central shops provided in each area headquarters. Most minor repair, lubrication, and servicing was provided by the use of mobile shop units. All major motor overhaul and transmission work was undertaken in the region's central repair shop at Grand Junction.

Roads

The good road maintenance work in the fall of 1950 paid for itself when these roads were re-opened for use in 1951. Very little work was necessary in opening the entire road system where camps were established. Some slides had occurred and some trees had fallen across the roads during the winter. A total of 236 miles of roads were maintained, and in addition 53 miles of new roads were constructed in 1951. The newly constructed roads were in the Redtable Mountain and Rabbit Ears' work units.

It was necessary to increase rates for tractor rental in 1951 to $14 per hour for D-8 cats and corresponding rates for the smaller sizes. Even at that rate, however, the cost of tractor rental was considerably less than it would have cost to move Forest Service equipment. The average cost of road construction in 1951 amounted to $670 per mile which is just slightly above 1950 costs.

The organization for road construction and maintenance was the same as that used on the 1950 project with an engineer at each area headquarters in charge of road construction and maintenance. In this way area supervisors were relieved of the details connected with this phase of the project.

Procurement

With the experience gained on the 1950 project in connection with contracting subsistence, horse hire, road construction equipment which is described under "Roads," and mixing and delivery of insecticide, these same services were contracted this year.

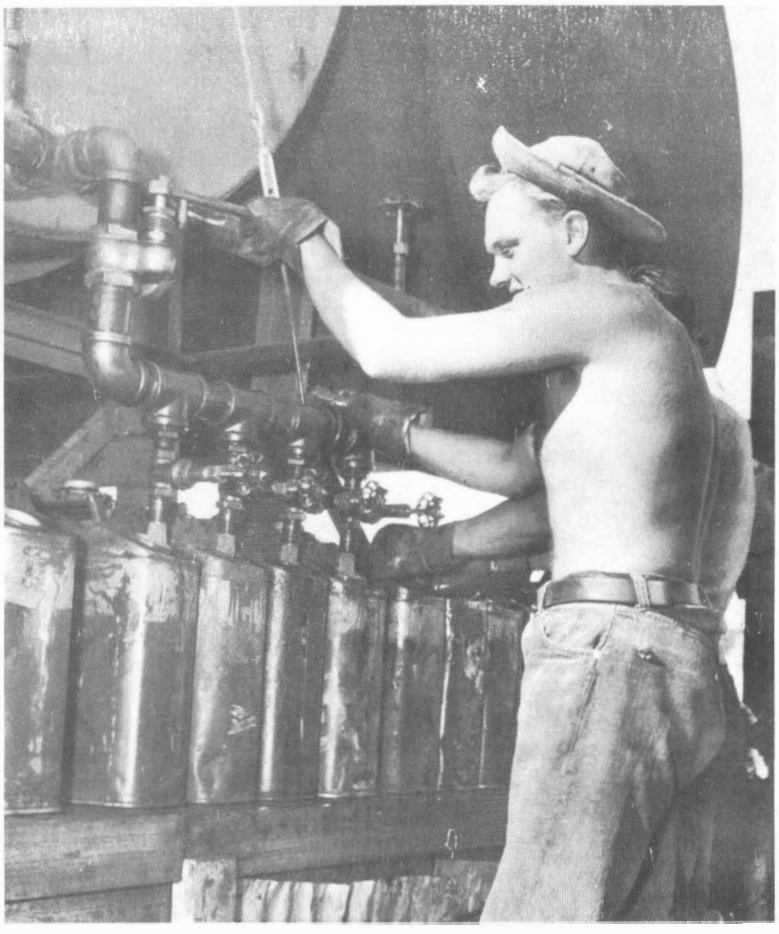
Subsistence

The mess contract which was at the rate of $3.05 per man day was approximately ten percent higher than the 1950 rate. Because of the constant turn-over of personnel and weather conditions the mess contractors probably came out with less margin than would be desirable from a business standpoint.

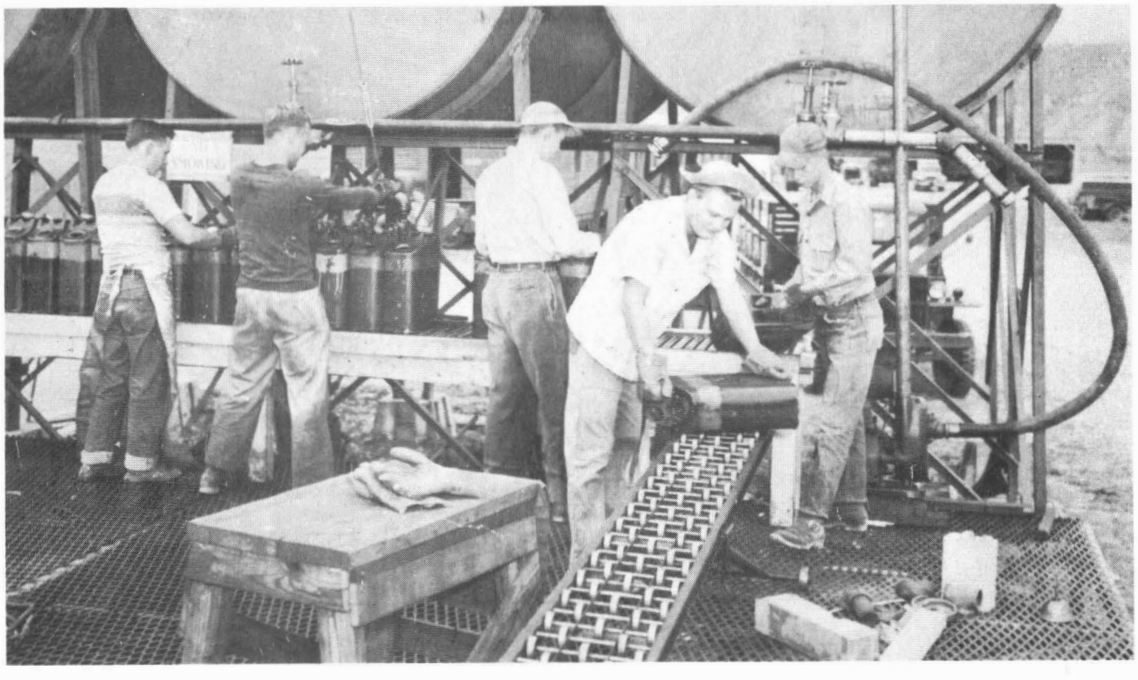
Horsehire

Thirty horses were contracted on the Kremmling Area. Here again the bid price of $4.75 per horse day was higher than in 1950 but the results were quite favorable in contracting this type of service. Saddles and equipment were furnished by the project and the contractor furnished feed and the wrangler.

PLATE IV



Manifold filling of jeep cans at
Eagle Ortho Depot.



Shows conveyor system at Eagle Ortho Depot

The Kremmling Ortho Depot in operation

Filling the bottom tier of cans at Kremmling

A $2\frac{1}{2}$ ton cargo truck loaded with filled jeep cans enroute to field ortho dump

Unloading filled jeep cans at field distribution dump

Insecticide

All of the orthodichlorobenzene was purchased and delivered to Denver prior to the start of field operations. Arrangements were made with the Rocky Mountain Arsenal (Department of the Army) near Denver, and General Services Administration at Denver Federal Center, for temporary tank storage facilities to store this ortho until used.

Bid invitations were circulated calling for quotations for furnishing burner oil, mixing with ortho at the prescribed strength of 6 parts oil to 1 part ortho, and delivery to field tanks. Only one complete bid was received, that of Empire Petroleum Company, for delivery of insecticide, mixed and ready for use, at Eagle and Kremmling tankage.

Close check was maintained on mixing, temperatures, deliveries, and billings, and contract specifications were met in every respect. Every delivery was made within the specified time and no delays occasioned at field stations through non-availability of tankage. When the project terminated without advance warning because of inclement weather, only a nominal quantity of mixed insecticide and no unused ortho remained in contractor's tanks. In accordance with the contract this remaining insecticide was purchased from the contractor and stored at Denver Federal Center.

Public Relations

Newspapers all over the State devoted much space to the 1951 project. The Denver Post especially gave considerable front page coverage to the project, supported by excellent articles by the Grand Junction Daily Sentinel, The Eagle Valley Enterprise, The Middle Park Times, The Steamboat Pilot and the Rocky Mountain News.

Several leading magazines continued to carry articles about the project.

Production Records and Accomplishments

From August 27 to October 20, 1951 a total of 199,002 trees were sprayed, over 71 percent of which required full treatment of the tree. This more intensive treatment is reflected in the amount of insecticide used per tree of 1.9 gallons as contrasted with 1.28 gallons in 1950. Total insecticide used--1 part orthodichlorobenzene to 6 parts of fuel oil--amounted to 377,347 gallons.

Additional tests were made in 1951 with ethylene dibromide, at a ratio of 1 part to 4 parts of water. Because of the fact that only one gallon of this chemical need be transported to treating areas, when water is available at the site, considerable savings in transportation and storage costs would result. If the results are satisfactory, the substitution of this newer chemical will be made as rapidly as possible in future control work.

Man days spotting and treating totaled 9,915 representing actual treatment of 20.1 trees per camp man day. Total project man days, exclusive of clerical and associated help in the director's office and the two area offices, amounted to 15,817 for an average of 12.6 trees treated per project man day. Included in this latter figure is camp establishment and breakdown, as well as the maintenance of 226 miles of roads.

Both 1950 and 1951 attacked trees were treated in all areas where control work was done. This gave complete control, or very nearly complete control, on the Hardscrabble work unit and practically completed the Cottonwood-Sheephorn and Piney units. A heavy snowfall, occurring the week end of October 20, forced the closing of all camps on both areas. Approximately a week's work remained on each of the Cottonwood-Sheephorn and Piney work units.

In addition to the 199,002 trees sprayed in 1951 an additional 2,722 trap trees had been felled by October 27, 1951, of which number 1,277 or 45 percent were felled by operators of going national forest sales at no cost to the Government. Future trap tree work will be carried on in the same manner capitalizing on experimental work to date which indicates that twice as many beetles are attracted to green down timber as to standing trees. The felled trees will be removed from the sale area next year after the flight season and the slabs burned. Those felled trees located in inaccessible locations will be sprayed.

Treating data is shown by areas and camps in the following tabulation:

ACCOMPLISHMENTS - 1951

Area and Camps	Roads Const.	Roads Mtce.	Man days	Trees No.	Trees Per Manday	Insecticide Gallons	Insecticide Per Tree	Man Days Super-vision	Man Days All other	Grand Total
Kremmling										
East Sheephorn	4.7	54.0	1346	15,112	11.2	46,435	3.1	167	2069	2236
Cottonwood	4.0	54.3	2214	40,482	18.3	86,950	2.1	181	2876	3057
Sheephorn	--	37.0	1622	38,149	23.5	75,030	2.0	124	2030	2154
Buffalo Pass	21.8	8.0	496	5,540	11.2	14,685	2.7	55	872	927
Area Total	30.5	153.3	5678	99,283	17.5	223,100	2.2	527	7847	8374
Eagle										
Hardscrabble	10.7	24.0	1621	41,584	25.7	59,445	1.4	194	2187	2381
Piney	--	47.0	1257	22,629	18.0	43,042	1.9	148	2129	2277
Gypsum	3.3	6.0	1243	33,590	27.0	46,740	1.4	183	2156	2339
Red Creek	8.5	5.6	116	1,916	16.5	5,020	2.6	64	382	446
Area Total	22.5	82.6	4237	99,719	23.5	154,247	1.5	589	6854	7443
Project Total	53.0	235.9	9915	199,002	20.1	377,347	1.9	1116	14701	15817

CAMP DATA

East Sheephorn — top camp strength 90-men August 29; treating period August 27 to October 17
Cottonwood — top camp strength 80-men September 2; treating period August 29 to Oct. 20
Sheephorn — top camp strength 90-men September 15; treating period September 5 to Sept. 23
Buffalo Pass — top camp strength 65-men September 19; treating period September 13 to Oct. 12

Hardscrabble — top camp strength 95-men August 27; treating period August 27 to October 12
Piney — top camp strength 85-men August 31; treating period August 30 to October 16
Gypsum — top camp strength 100-men September 8; treating period August 29 to Oct. 16
Red Creek — top camp strength 20-men September 3; treating period September 1 to Sept. 6

CHRONOLOGY

August 17. House approved $1,000,000 for Colorado Engelmann Spruce Bark Beetle Control Project. Senate action needed but it appeared the appropriation would be approved in a few days since the Senate had already included these funds in prior appropriation bills' action.

August 20. Received a wire from the Chief that the Department had approved initiation of the project at once, setting up $300,000 of regular forest pest control money for use to get underway, pending availability of appropriated funds.

Immediately upon receipt of this information, Area Supervisors Leighou and Heaton and Dr. Wygant of the Bureau of Entomology and Plant Quarantine were called, notified of the action, and asked to come to Denver at once for a conference on camps to be established, policies, etc. On the afternoon of August 20 and the morning of August 21 conferences were held in Denver with Area Supervisors Leighou and Heaton and Dr. Wygant with Director Brown and Assistant Regional Forester Nelson. Decision was made to install camps immediately with the following priority: Kremmling area--Cottonwood, East Sheephorn, Elliott Creek, if needed, and Sheephorn; Eagle area--Hardscrabble North, Piney No. 2, Hardscrabble South, and Piney No. 1, if it is needed.

Calls were immediately placed for detailers from other regions and from the forests in this region.

August 21. Administrative Assistant Leypoldt from the Routt obtained permission from the Kremmling Light and Power Company to rent the same office space that was leased to the project in 1950. The Kremmling area was activated on August 22 when Area Supervisor Heaton and Administrative Assistant Leypoldt arrived.

The Eagle area was activated the morning of August 20 when Supervisor Leighou left Glenwood Springs for Denver. He left instructions for his forest personnel to initiate the establishment of area headquarters and field crews to start erecting Hardscrabble North camp.

August 24. The initial training was conducted on the Kremmling area at Elliott Creek in the Cottonwood-Sheephorn area. The Bureau of Entomology and Plant Quarantine representatives, together with Training Officer Whipple and Area Training Officers Harmon and Miller, met and agreed on the types of trees that would be treated in 1951, as well as spotting techniques to be used. After this meeting, Area Training Officers Harmon and Miller were sent to their respective areas to head up and start the training of spotters that would be needed by Monday, August 27.

Washington called and stated that Section 407 of the Agricultural Appropriation Bill specified that overtime would be paid at regular rates of pay for all work over 40 hours per week in forest pest control work as well as emergency fire fighting services. There was considerable discussion regarding the effect of this policy on the employees already hired and promised time and a half for this work. Washington stated that they would get a clarification on this policy on Monday from the Department.

August 25. Eagle area requested enough men on Monday, August 27, to man their Hardscrabble North camp. They estimated a need for 60 men, stating that they could hire the rest of them locally for this camp. Recruitment was based on this request.

August 27. Washington was still undecided about policy to be used on overtime on the project because of the wording of Section 407 of the Agricultural Appropriations' Act. Department officials were to confer on Tuesday and let Region 2 know whether or not this would apply only to 676 employees or to regular employees as well. In the meantime, overtime for Saturday, August 25, had been covered by policy letter put out by the acting regional forester, stating that overtime will be handled under the old overtime act.

Engineering, through Mr. Marion Lamb, had been active in getting the roads opened on each area. The maintenance outfit from the Arapaho National Forest moved into Kremmling Thursday, August 23. The maintenance machinery from the White River National Forest was made available Wednesday, August 22, so that the roads were opened up as soon as possible on each area. D-4 cats were requested from various forests in the region to be used in the maintenance of existing roads. Contractors with heavier equipment were signed for road construction purposes where needed.

August 28. Area Supervisor Leighou reported that North Hardscrabble camp was manned with approximately 90 men. Training of treating crews was initiated and the treating program started.

Kremmling area reported East Sheephorn camp had been manned and training of the treating crew was underway. Treating is to be started August 29. Construction of Cottonwood camp was underway. Assistant Director Anderson was at Kremmling to help them in any way possible with their camp construction program.

Camp equipment for the Piney No. 2 and the Cottonwood camps had been shipped out from the Denver Federal Center, both of these camps to be manned with Indians. Recruitment Officer Lundell left Denver on Tuesday, August 28, for the Indian reservation in New Mexico to recruit Indians and send them to the areas. The Indians arrived at

Kremmling on Saturday and at Eagle on Friday, August 31. They were immediately sent to their respective camps where training got underway. By Monday morning, September 3, both of these crews of Indians were treating trees after receiving initial training.

With the establishment of the Piney No. 2 and the Cottonwood camps, construction was immediately started on the Sheephorn camp on the Kremmling area, and the Gypsum Creek camp (Hardscrabble South last year). These two camps are planned to be manned also from the Navajo reservation.

September 1. A conference was held in Denver with Area Supervisors Leighou and Heaton with the regional forester, project director and his staff, and Assistant Regional Foresters Hessel, Hilton, Crawford, and Nelson. The first thing to be discussed at this meeting was the overtime policy to be established on the project following receipt of guide lines from the Washington office. The policy that was finally adopted resulted in the writing of the regional forester's K-SUPERVISION-Hours of Work memorandum of September 5, covering overtime policy for the project.

Area Supervisors Heaton and Leighou gave progress reports on their respective areas giving the names of the camps filled and where treating would be undertaken. It was also agreed that Area Supervisor Leighou would put in a camp on Red Creek, situated about midway on the north side of the Red Table Mountain unit. Dr. Wygant of the Bureau of Entomology and Plant Quarantine summarized the work that his crews would be doing during the summer. They were concerned mainly with the survey of 1951 trees to get ready for the 1952 program. In addition, they planned to have technicians in each of the camps and to scout the treating areas for location of work.

September 5. Melichar called from Washington to advise that the Sub-committee on Agricultural appropriations would be in Colorado on September 10 to look over the infested area. Congressman Aspinall had already given Regional Forester Cliff details of this visit and was busy in making preliminary arrangements for them.

Recruitment Officer Lundell left for the Indian reservations to recruit additional Indians for the Sheephorn camp on the Kremmling area and the Gypsum Creek camp on the Eagle area.

The Bureau of Entomology and Plant Quarantine planned to scout Rabbit Ears area during the week to determine the feasibility of putting in a camp near Buffalo Pass north of Rabbit Ears Highway. If recommended, camp No. 4 in the Kremmling area would be established.

September 7. Seventy-five Indians arrived from the Navajo reservation for the Gypsum Creek camp. The same number was to be recruited for the Kremmling area to arrive on September 8 but Lundell could obtain only 18 of them because of the conflict with a ceremonial dance on the reservation. He stayed over the week end for the purpose of recruiting again on Monday for the Kremmling area.

Dr. Wygant was in Denver for conference with Regional Forester Cliff, Assistant Regional Forester Nelson, and Director Brown. Decision was made to go ahead with the camp on Rabbit Ears because of the result of the Bureau of Entomology and Plant Quarantine survey in that area. Area Supervisor Heaton's office was contacted immediately and informed of this decision. He will begin the location of the camp site immediately and will move the old Elliott Creek camp to that location.

September 8. A conference was held with Dr. Wygant, Congressman Aspinall, Regional Forester Cliff, Assistant Regional Foresters Nelson and Hessel, and Director Brown. Plans were made at this meeting for the itinerary of the trip with the Agricultural Appropriations' Sub-committee. Detailed plans were made for taking this party to Kremmling and escorting them to the control area. Arrangements were also made with Area Supervisor Heaton for conducting them throughout the area.

September 10. Regional Forester Cliff met with the following members of the House Agricultural Sub-committee on Appropriations at the Shirley-Savoy Hotel: Congressman Carl Anderson from Minnesota, Walter Horan from Washington, George Andrews from Alabama, a member of the Full Appropriations' Committee, and Ross Pope, clerk of the Agricultural Sub-committee. Regional Forester Cliff and Dr. Wygant of the Bureau of Entomology and Plant Quarantine took the above-named members to Estes Park and over the Rocky Mountain National Park to Granby and Kremmling. Director Brown met Congressman Wayne Aspinall at the airport at 11:00 p.m. and took him to Kremmling.

September 11. The Congressmen were flown over the beetle infested area in planes provided by the Kremmling Timber Company and local business men of Kremmling. Following this flight they were taken over the treating area by way of the Elliott Creek road to the East Sheephorn camp and on to the Cottonwood camp where lunch was served. After lunch, the party looked over some of the treating work being done by the Navajo Indians and then returned to Kremmling in time to catch the California Zephyr which went through Kremmling approximately 4:00 p.m.

September 19. Regional Forester Cliff and Director Brown accompanied by Area Supervisor Heaton looked over the country north of Rabbit

Ears Pass with the view of establishing a camp in the vicinity of Buffalo Pass. Area Supervisor Heaton's men had already been up there to locate the road and the camp site. Tractor bulldozers from the Jimmy Johnson timber operations, just below Buffalo Pass on the east side, were hired to punch the road from the logging operations to the summit.

During this same time the Eagle area had been working on the road up Red Creek from the Gypsum Creek road. They planned to have Red Creek camp ready for occupancy by the end of the week.

The Elliott Creek camp left Kremmling loaded in three army trucks loaned from Lowry Air Force field in Denver and construction of the Buffalo Pass camp was gotten under way. Likewise, the Red Table camp, occupied in 1950 was moved to the Red Creek camp site and construction of this camp was under way.

September 22. Eight cargo trucks arrived on the area from the Atomic Energy Commission at Pasco, Washington. Region 6 made the arrangements for getting these vehicles and reconditioning them at their Pendleton, Oregon, shops. They were driven from Pendleton to the areas by insured Drive-away from Salt Lake City.

Mr. Hubbard, the Navajo Placement Officer in Denver, advised that it might be possible to recruit some Sioux Indians from the Pine Ridge reservation in South Dakota since it appeared that it would not be possible to recruit sufficient Navajo Indians from New Mexico. Mr. Harmon from the Black Hills, detailed to the project, was temporarily at Deadwood, South Dakota. He was called and asked to contact the Sioux Placement Officer at Hot Springs, South Dakota, and arrange to recruit approximately 100 Indians from the Pine Ridge reservation. Area Supervisor Heaton was also called and advised of this arrangement. The project training and safety officer, Mr. Whipple, was asked to fill in behind Mr. Harmon on the Kremmling area during his absence.

Mr. Melichar, Assistant Chief of the Washington Office Timber Management Division, was on the area the week of September 24-28. He arrived the night of September 24 and spent the afternoon of the 25th and 26th on the Eagle area. The latter part of the week was spent on the Kremmling area. On both areas trips were made to inspect the work of the treating crews and to Red Table and Buffalo Pass units.

Storms

The first storm of the season occurred on the evening of September 11. Flurries of snow occurred at Kremmling and around Eagle; however, by the next morning, September 12, the storm had passed and clear skies

prevailed. Some snow was on the ground and around a half to one full day was lost in the various camps. The next storm occurred on the night of September 20, and approximately three inches of snow fell in Denver and throughout the Eastern Slope; however, on the treating areas, especially around Kremmling, no snow was present at all the next morning. Approximately one-half day of treating was lost on the Kremmling area in two camps, and no time was lost on the Eagle area because of this storm. Approximately 44 men quit the project from the Kremmling area and around 50 quit from the Eagle area. About half of the "quits" from Eagle were Indians who returned to the reservation for a festival in progress there.

General Storm

The first general storm of the season occurred October 3. It started snowing on the areas the morning of October 3, resulting in a large exodus of men from the Hardscrabble and Buffalo Pass camps. Both of these camps are situated at high elevations and the full force of the storm hit them. Practically all of the laborers quit in both camps leaving nothing but the overhead. A big withdrawal from other camps also occurred as a result of this storm. By the night of October 3 approximately six inches of snow was on the ground on all the treating areas. By the night of October 4 approximately eleven inches of snow was on the ground, and snowing continued all of that night. By the morning of October 5 it was snowing in the towns of Kremmling and Eagle. The storm broke the afternoon of October 5, and clear skies prevailed over most of the areas on Saturday, October 6.

Kremmling area started their work week on Sunday, October 7, and treated from their Cottonwood camp. The Eagle area started to treat on Monday, October 8, from the Gypsum Creek and Hardscrabble camps on Hardscrabble Mountain. The exodus from the camps resulted in a decision to withdraw the Buffalo Pass and Red Creek camps in both areas. Men who were left were transferred to other camps. The Buffalo Pass camp had a total of fifteen inches of snow which completely shut down the treating operations. The Sheephorn East camp on the Kremmling area was evacuated on October 11, and all the men were transferred to the Cottonwood and Sheephorn camps.

Recruiting Officer Lundell went back to Window Rock, Arizona, on October 8 to see what he could find in the way of additional laborers. He shipped one bus load to Kremmling which arrived on October 9, and one bus load to Eagle which arrived on October 10. On October 11, another bus load arrived at Kremmling from the Navajo reservation. With these Indians it was decided that sufficient manpower was on hand to complete the areas as programmed, and the recruiting was closed as of the week ending October 12.

During the week of October 8 the Eagle area started to treat on Hardscrabble following their shut down after last week's storm.

The manpower was as follows on the Eagle area at that time:

Gypsum camp	66
Hardscrabble	24
Piney	49
Red Creek	5
Total camp strength	144

The total camp strength on the Kremmling area was as follows:

Sheephorn	76 (6 detailers, 6 classified, and 64 laborers)
Cottonwood	61 (4 detailers, 12 classified, and 45 laborers)

At the Buffalo Pass camp most of the men walked out leaving only 3 laborers and 13 classified and overhead.

Friday night, October 12, another snow storm hit both areas. This storm left eight inches of snow on the Piney and the Cottonwood-Sheephorn area. This will change our plans for consolidating the Gypsum Creek and the Hardscrabble camps into the Piney camp. Forty-eight men left the Gypsum Creek camp on Saturday, October 13, because of the snow storm. Only 30 men were left on the Piney area. The crews were not able to treat on Saturday, October 13, because of this last storm; therefore, they did not finish treating the Hardscrabble area. About 1,500 trees remained to be treated on the area starting the week of October 15. It was estimated these would take a couple of days with the reduced crew.

On the Kremmling area, starting the week of October 15, the manpower was as follows: one camp 75 men, the other camp 50 men; making a total of 125 camp strength in the two camps (Cottonwood and Sheephorn). Area Supervisor Heaton reported that it might take two weeks longer to complete the treating in this area if the weather permitted. Treating could not be completed in the so-called "hole" extending into Piney Creek but the Bureau of Entomology and Plant Quarantine men figured that it would be safe to leave this area for the winter.

October 16. Eagle area released all men. All trees were treated on the Hardscrabble Mountain unit. Some work remained on Piney, but it could hold over until 1952. Kremmling planned to continue the rest of the week, or as long as they could maintain an efficient operation.

October 21. Snowed previous night and part of the day. Eight inches on ground at camps on Kremmling area. Decided to close field work at Kremmling.

October 22. Cottonwood and Sheephorn camps started closure, removing all goop, goop cans, and other equipment from woods and packing camp equipment.

October 23. Sheephorn camp released all men. Thirty-seven Navajos sent back to New Mexico.

October 24. Cottonwood camp released their men. Thirty-eight Zunis sent back to Arizona. Kremmling and Eagle areas stored camp equipment for winter. All work crews released.

October 28-29. House Agricultural Committee members looked over insect killed timber along Rabbit Ears Pass and saw a demonstration of treating techniques.

Congressman Poage	Texas - Chairman
Congressman McMillan	South Carolina
Congressman Harvey	Indiana
Congressman Patten	Arizona
Research Specialist John Heimburger	

They were accompanied by Congressmen Rogers and Hill of Colorado. In addition to the Congressmen, Gladwin Young of the Secretary's Office accompanied the group. Forest Service and Bureau of Entomology and Plant Quarantine people who accompanied the group were Cliff, McGinnies, Nelson, Wygant, and Brown from Denver and Fort Collins, and Heaton, Martin, and Harmon from the Kremmling Area.

Costs

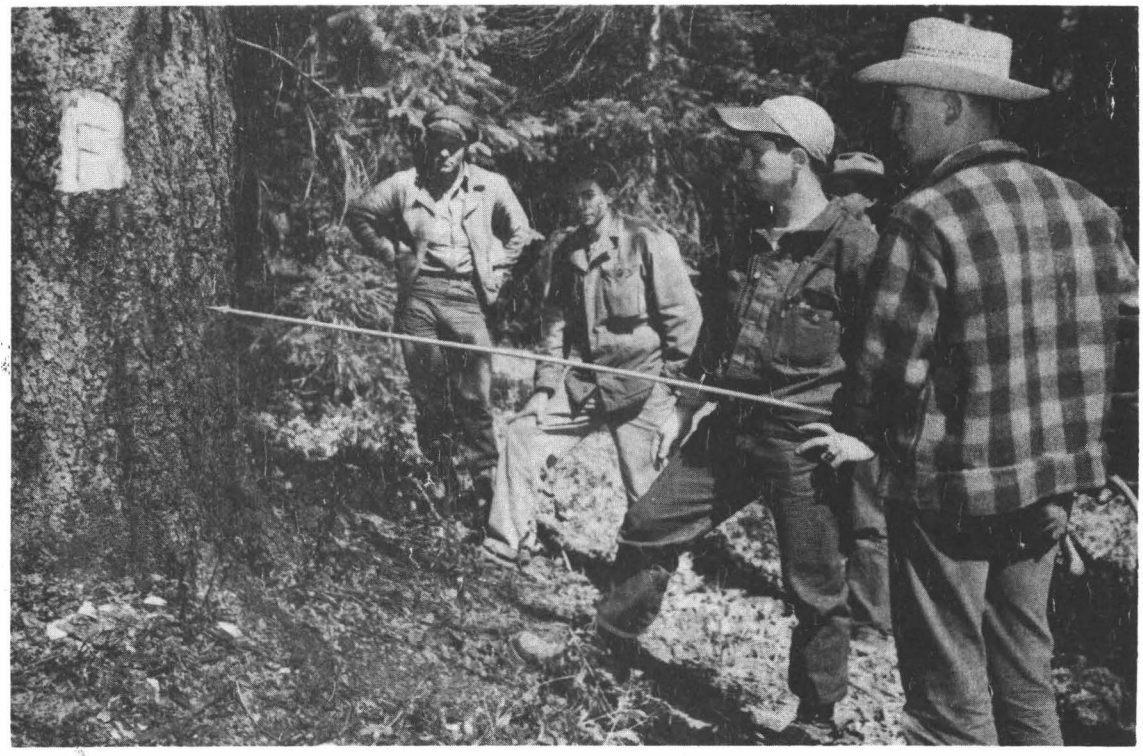
Expenditures through December 31, 1951--at which time operations had ceased except for minor conditioning of equipment, preparation of reports, and planning for resumption of work next spring--totaled $596,174. Distribution of these expenditures is as follows:

Director's office and warehouse	$ 32,214
Both area offices	28,483
Both area depots	36,672
Insecticides	56,575*
Camp operation	262,783
Road construction and maintenance	42,278
Equipment operations, repair, and replacement	137,169
Total	$596,174

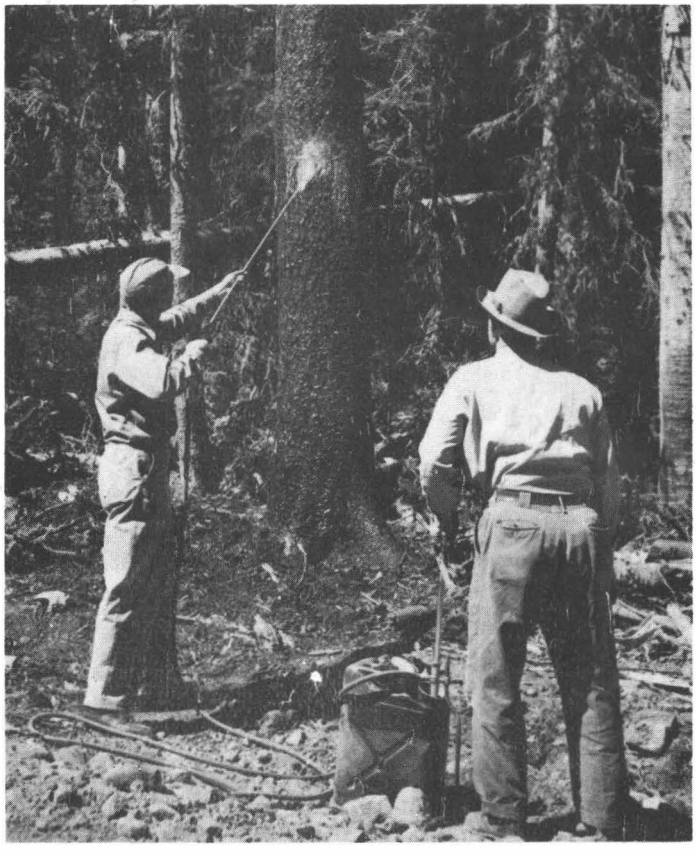
* Not including $92,472 worth of orthodichlorobenzene purchased from fiscal year 1951 funds--$62,532 of which was used in the 1951 program.

On the basis of the $596,174 expended in 1951 plus orthodichlorobenzene costs of $62,532 which were financed from fiscal year 1951 funds per tree costs averaged $3.30--distributed as follows:

Director's office supervision, mapping, and warehousing	$0.16	or 5%
Area supervision	0.14	or 4%
Area depots and warehousing	0.18	or 5%
Insecticide	0.60	or 18%
Spotting and treating	1.32	or 40%
Road construction and maintenance	0.21	or 7%
Equipment operation, repair, and replacement	0.69	or 21%
Total	$3.30	100%

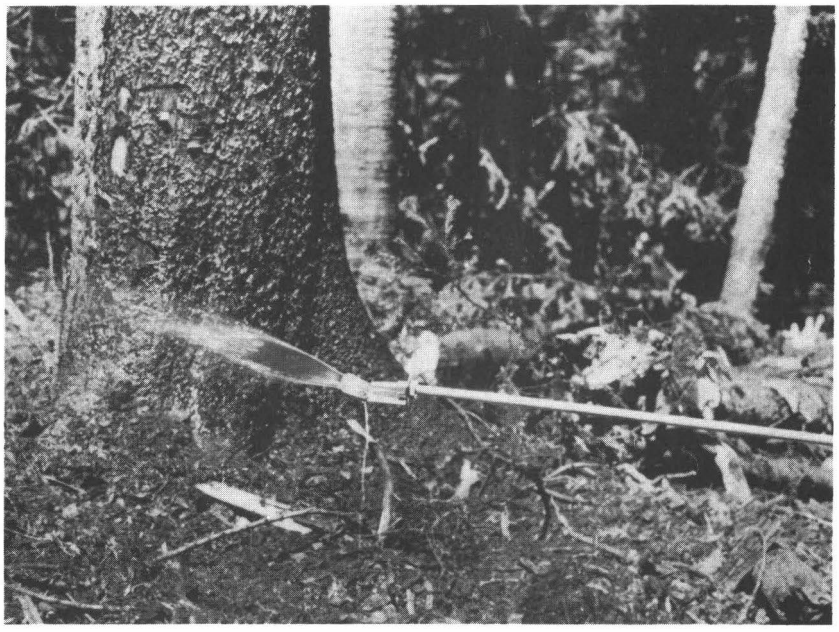


The treating crew learning the correct application of "goop"

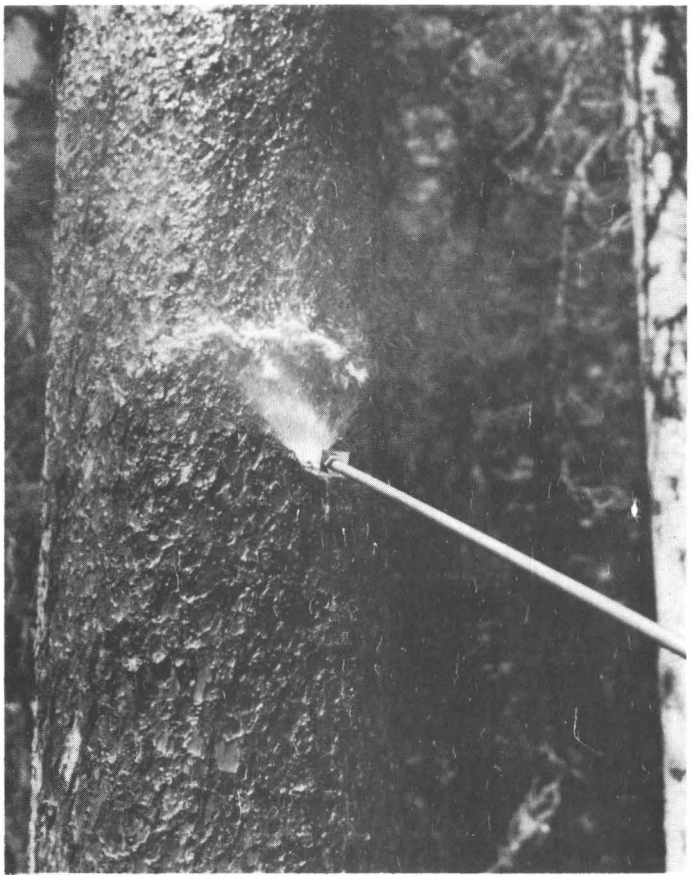


The treating crew in action. The pump man maintains constant pressure.

Showing the pencil stream flowing from the nozzle without using deflector.



Showing the wide stream flowing from the nozzle with the deflector in use. (Note: Deflector was designed and produced in connection with the 1950 project.)



Showing the flow of insecticide down the trunk of a tree

The treating crew with "Old Dobbin" enroute to a new strip

THE JOB AHEAD

The Bureau of Entomology and Plant Quarantine conducted field surveys during 1951 to determine the extent of the infestation as compared with the findings of the 1950 survey. The results of this survey were very encouraging. The 1950 survey showed a need of treating over 1,600,000 trees located upon 51 separate work units. The 1951 survey shows a probable need of treating 400,000 trees located upon 18 separate work units. This indicates that previous control, work of predators, and climatic factors all contributed to the decline of the beetle population.

The estimate of the number of trees to be treated in 1952 includes 225,000 1951 attacked trees and 175,000 trees estimated to be attacked in 1952. The trees that will be attacked in 1952 are based on an appraisal of the beetle population in the 1950 attacked trees. The 1951 winter surveys indicated approximately 87 percent mortality of beetle population from low temperatures from which the estimate of 1952 attacks were forecasted.

By comparing the surveys made in 1950 and 1951, entomologists and foresters can forecast that the "back is definitely broken" of the Colorado Engelmann spruce beetle infestation.

SURVEY RESULTS
ENGELMANN SPRUCE BEETLE OUTBREAK IN COLORADO
1951

Block	Name	Acres	No. of 1951 Infested Spruce: Full Attacks	Partial Attacks	Basal Fill-ins
1	U.S. 40 to Luna Lake	36,200	39,140	9,780	42,360
2	Chimney Rock	1,330	280	440	2,500
3	Elk Mountain	2,344	1,960	1,030	4,640
4	Williams Ridge	2,990	2,000	1,490	4,180
5	Surprise Lake	1,280	850	630	920
6	Elliott Creek	4,218	1,690	840	2,100
7	Cottonwood Peak	7,574	8,630	5,300	14,400
8	Meadow Creek	973	1,670	640	550
9	Red & White Mountain	3,557	5,650	4,840	6,080
10	Stone Creek	870	520	350	260
11	Beaver Lake	795	4,680	1,330	950
12	West L.--East L.	300	1,060	625	690
13	Squaw Creek	524	315	315	545
14	Triangle Park	237	200	0	0
15	East Brush Creek	315	1,510	280	280
16	Mount Eve	20	300	80	110
17	Hardscrabble Mountain	718	3,550	140	720
18	Red Table Mountain	16,370	57,130	15,400	55,490
	Total	80,615	131,135	43,510	136,774

Total 1951 full attacks (131,135) plus partials (43,510) = 174,645

Total rounded to 175,000

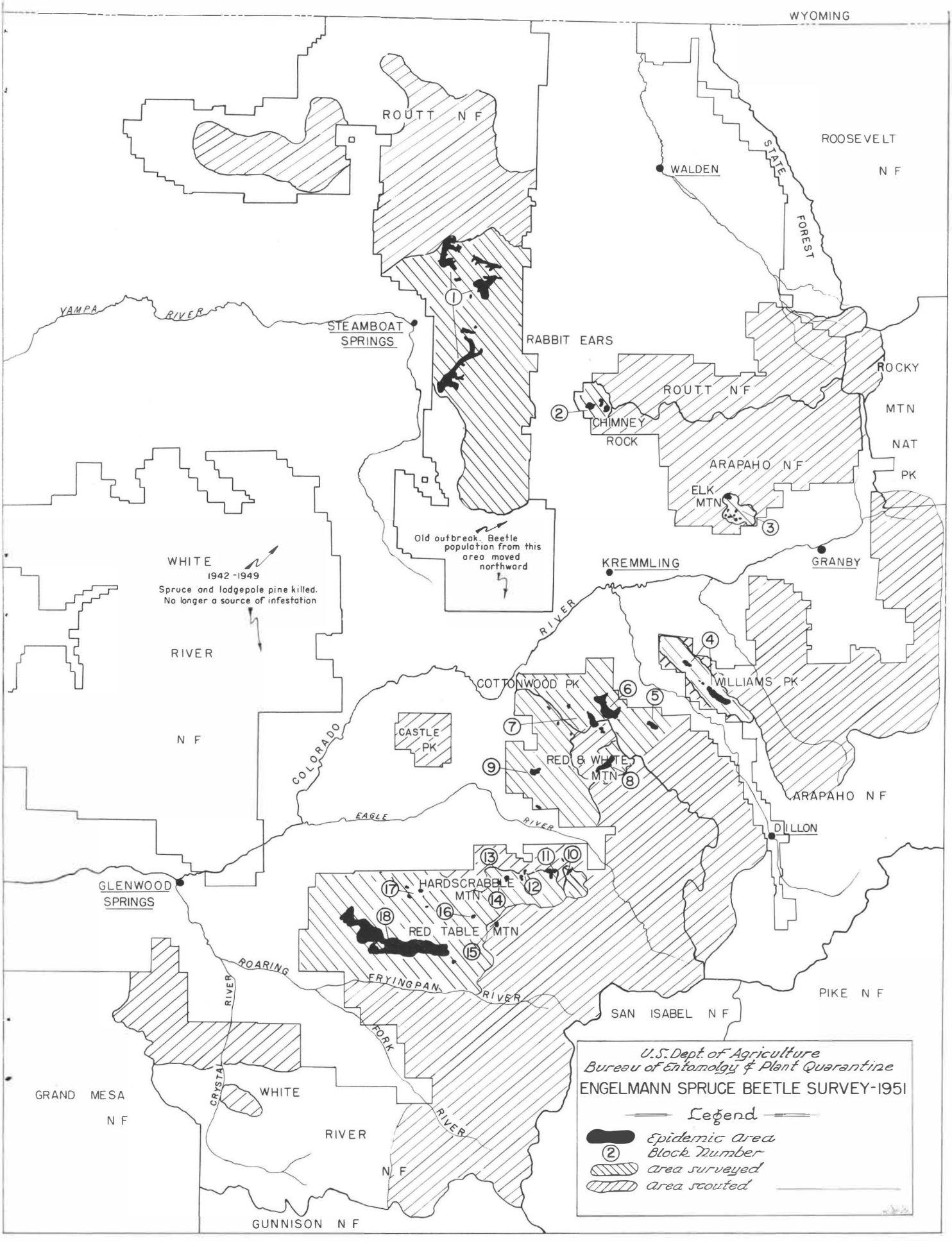
Approximately one-third of the fill-ins need treating 50,000

Total 1951 trees to treat in 1952 225,000

The estimate of the 1952 attacks must be based upon the 1950-attacked trees. The surveys made in the spring of 1951 showed approximately 87 percent mortality from low winter temperatures and woodpecker feeding. It is estimated, therefore, that sufficient beetle populations exist to attack approximately 175,000 trees in 1952.

A summary of the estimated number of trees to be treated in 1952 is as follows:

Number of 1951-attacked trees	225,000
Number of 1952-attacked trees	175,000
Total	400,000

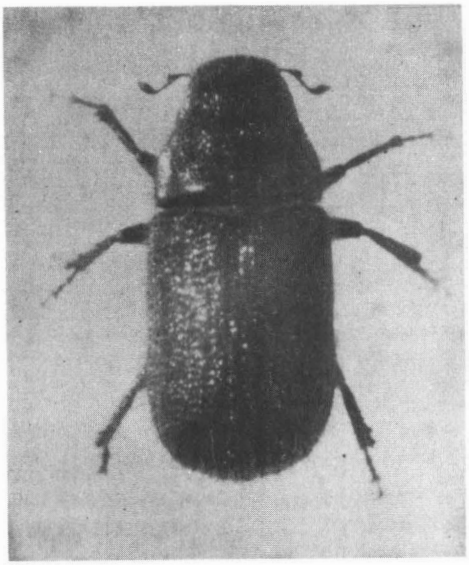


GPO 82-9000415

LIFE HISTORY OF THE ENGELMANN SPRUCE BEETLE

Attacking Adults

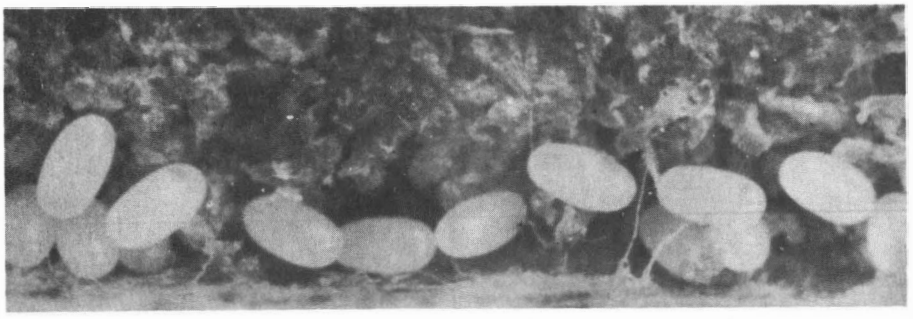
Soon after snow melts in the spring, mature adults emerge from under the bark of trees where they developed and that they killed. They fly short distances to nearby green trees or farther when no local ones are available, in which to build their egg galleries. Several thousand beetles attack a single tree in a day or two; trees are soon overcome by the mass attack. Females followed by males construct a vertical gallery in the living inner bark about 7 inches long; in it she lays about 140 eggs. The period of attack extends from about June 21-August 1. Each pair of insects builds one gallery per season. During August and September these parent adults come out of their galleries and congregate under the bark at the base of the tree. Those with sufficient vigor emerge again next spring to attack new trees and lay an additional batch of eggs.



Adult- 10X

Egg Stage

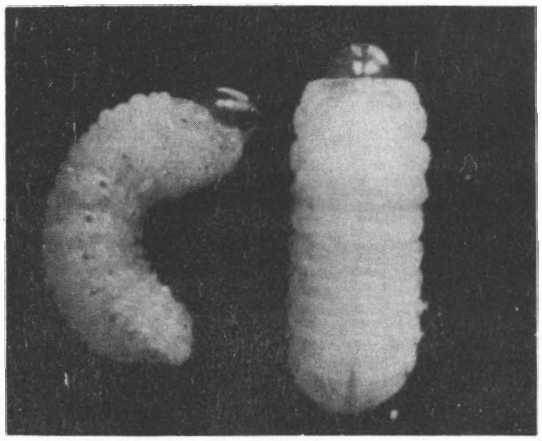
Eggs are laid during July and early August. They hatch in about 14 days, are pearly white and barely visible to the naked eye.



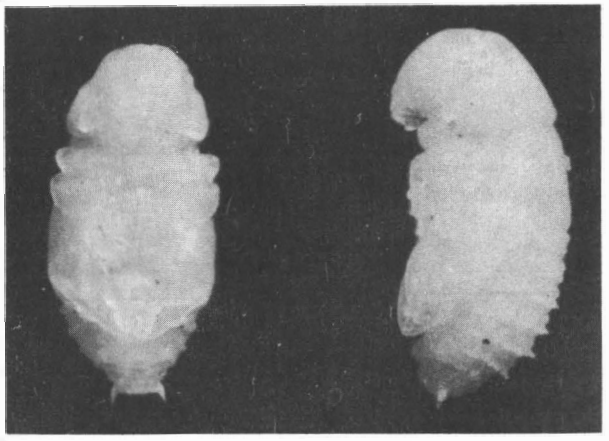
Eggs - 30X

Larval Stage

Pupal Stage



Larvae-8X



Pupae - 8X

Larvae feed in a mass on the living inner bark at the side of the egg gallery consuming it as they go. When about 1/3 grown, usually about the last of August and early September, they make separate sinuous feeding galleries throughout the inner bark. By October 1 feeding stops because of cold temperatures. The larvae remain dormant in the inner bark throughout the winter. Feeding is resumed in June of the following spring. The larvae reach the full grown stage in July when each builds a cell in which to pupate.

The pupal stage is a transformation period from the larval to the adult stage. No feeding is done during this stage - largely occurring during late July and early August. The pupal stage lasts about two weeks.

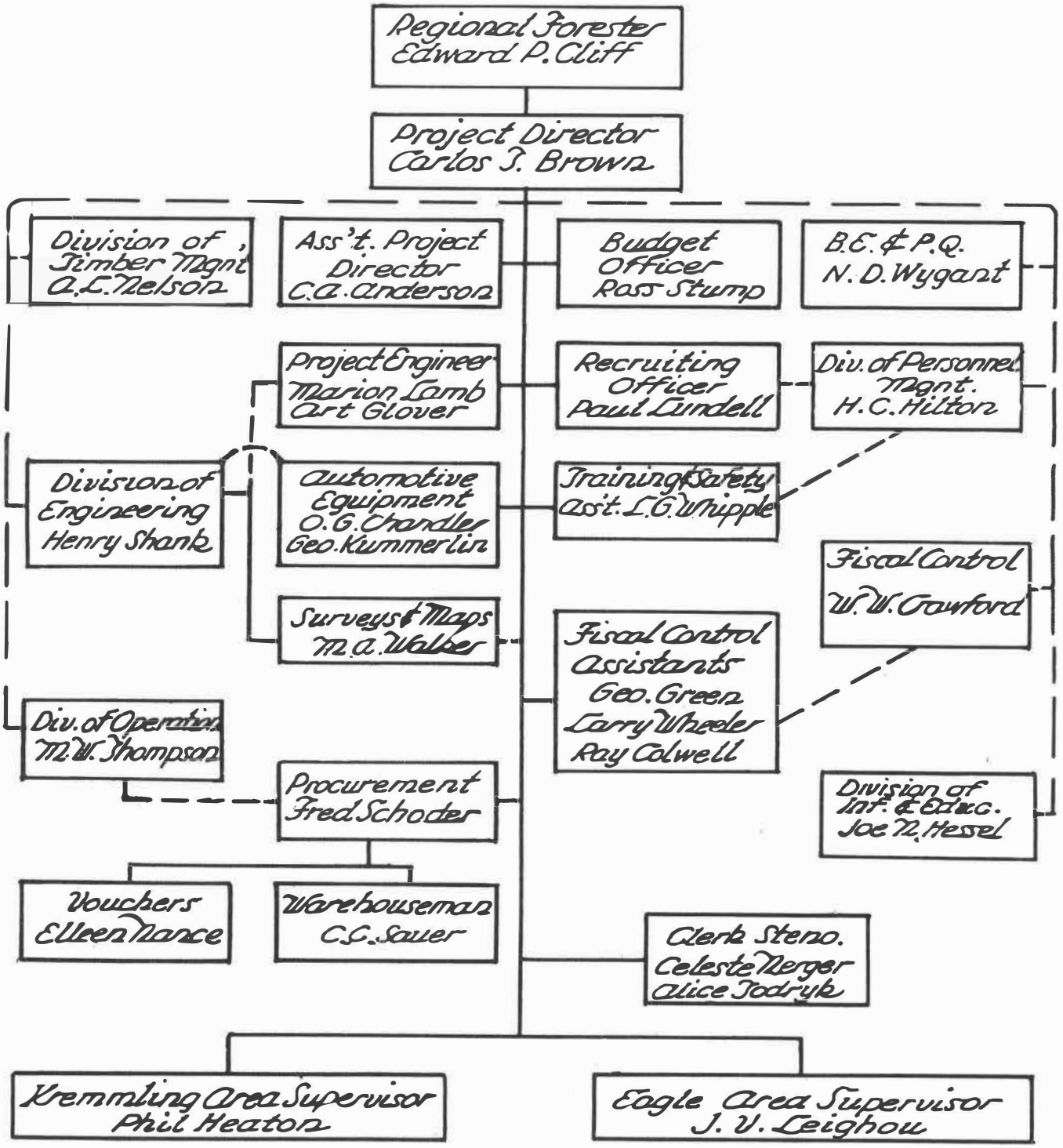
New Adult Stage

Adults, first cream-colored, gradually change to a reddish-black stage over a period of about two weeks. During this time, they feed on the inner bark. In late August and all of September, most of these newly-formed beetles emerge from the bark of the upper stem of the tree to congregate beneath the bark at the base of the tree. The following spring they are mature and ready to attack new trees. The life cycle is completed in two years: i.e., progeny of the beetles from the 1949-infested trees will be mature and ready to attack new trees in June and July of 1951.

1/3 GROWN LARVAE FEEDING IN INNER BARK - 2 X

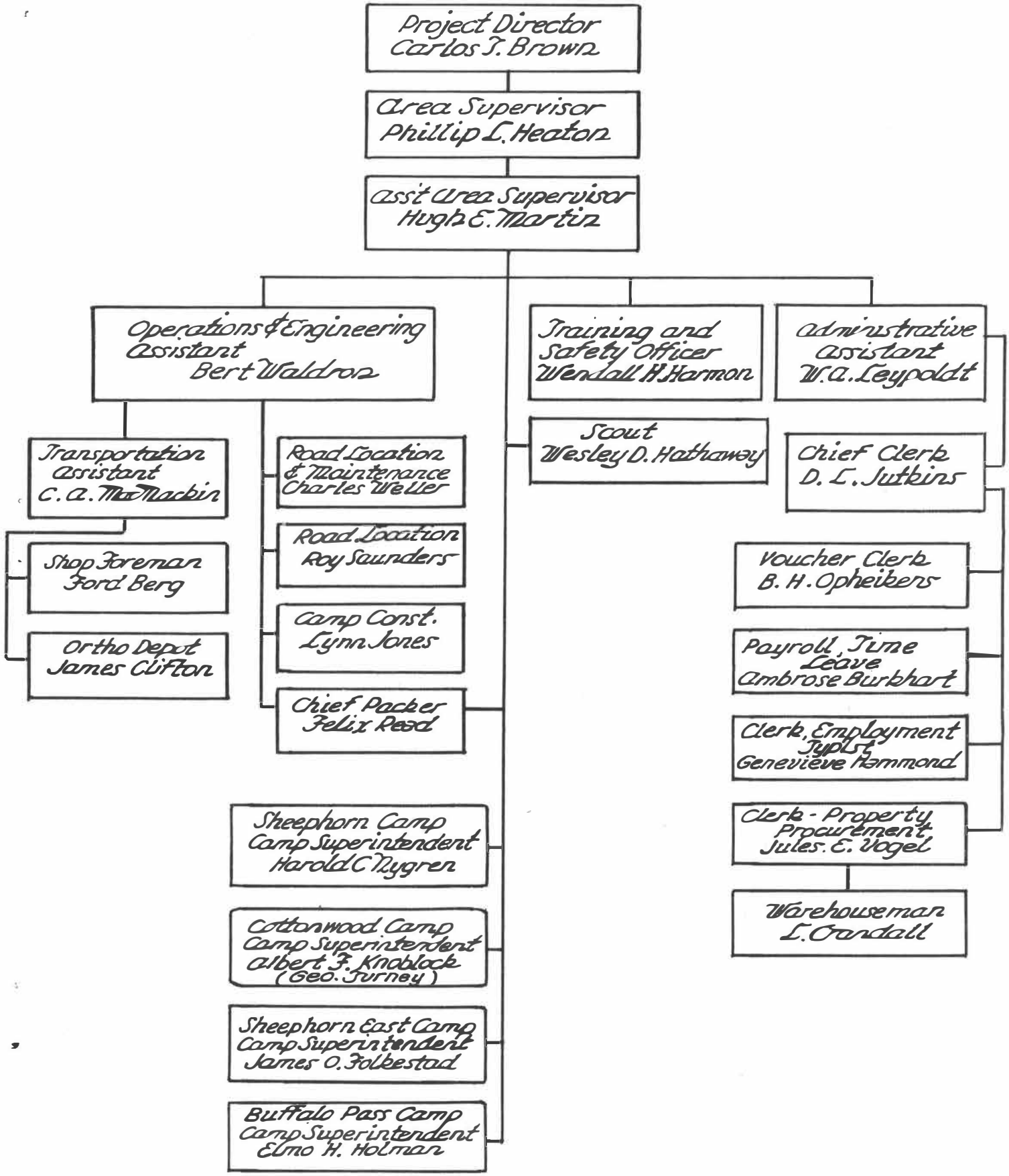
BARK REMOVED TO SHOW WORK

DIRECTOR'S OFFICE ORGANIZATION CHART



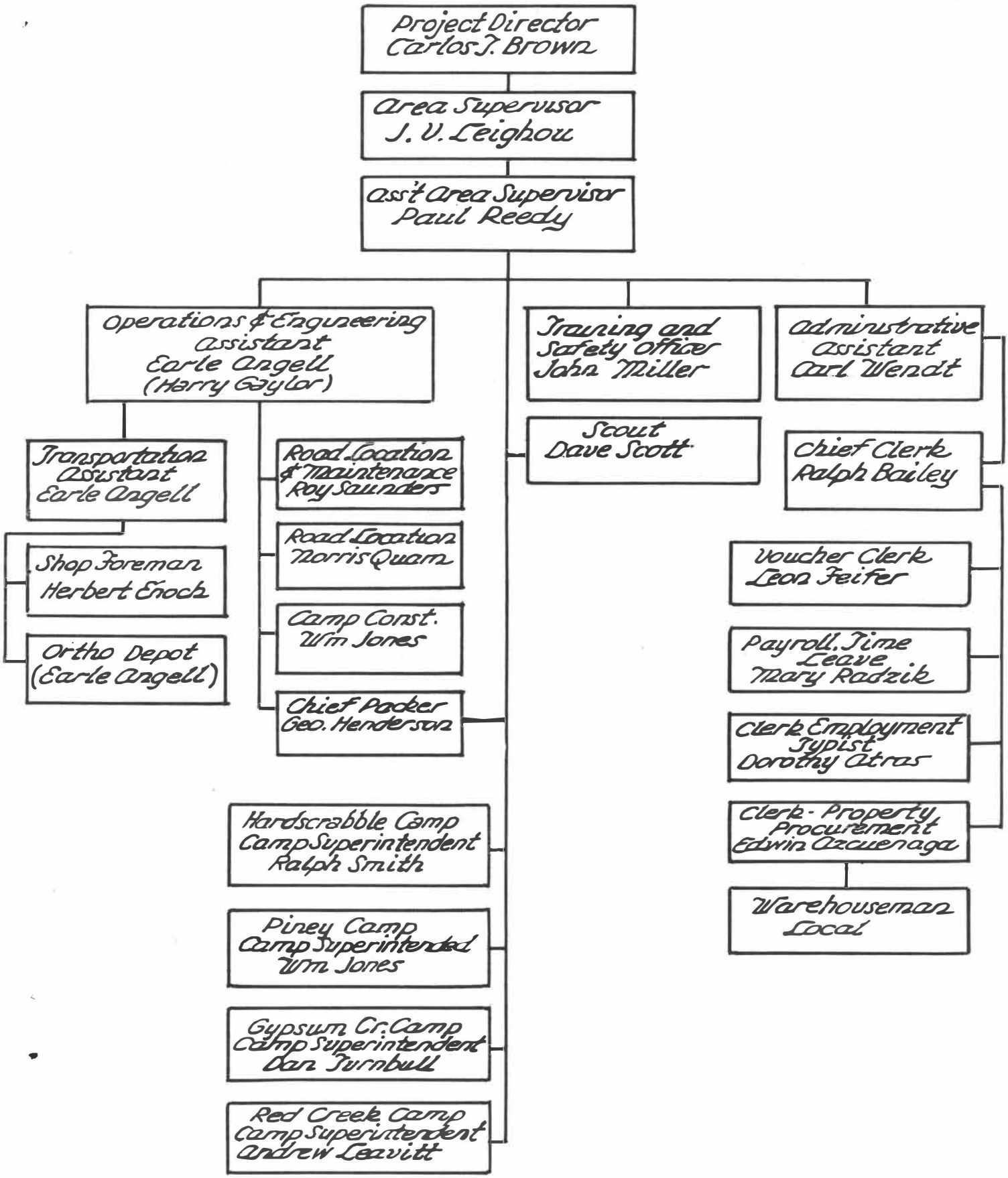
FEW '52
GPO 83-00004-37

KEMMLING AREA HEADQUARTERS
ORGANIZATION CHART



FE 52
CMO 83-00004437

EAGLE AREA HEADQUARTERS
ORGANIZATION CHART



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